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(54) A RIVET

(71) We, UNITED-CARR LIMITED, a British Company of 57 Chiswell Street, London EC1Y 4FY, England (formerly of 27 Regent Street London SW1) do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a synthetic plastics blind rivet which is particularly, although not exclusively suitable for securing a member such as a beading to a panel or for riveting two panels together.

It is known to manufacture a blind rivet from a metal or a metal alloy in which the rivet comprises a hollow shank and a mandrel. In use the shank is inserted through two apertured workpieces with the mandrel assembled through the shank and with the tail of the mandrel projecting from the blind side of the shank. The stem of the mandrel is then gripped and pulled so as to draw the tail of the mandrel into the hollow shank. This expands and locks the shank in the workpiece. A further pull is then applied to the stem of the mandrel to break the stem away from the remainder of the mandrel at a grooved neck portion thereby completing the assembly.

It has been found that this known type of metal rivet has the disadvantages that it does not always provide a water-tight seal in the aperture or apertures in the workpiece and is liable to corrode. Many efforts have been made to produce a plastics rivet which functions in the same manner as a metal blind rivet but these attempts have hitherto not been entirely successful because of the tendency of plastics material to creep or resile and because of the difficulties of moulding the complex shape of an integral hollow shank portion and mandrel.

It is the object of the present invention to provide a blind rivet which can be manufactured from a synthetic plastics material so as to provide a water-tight seal of an aperture in a workpiece and which will not creep or resile thereby providing a secure and lasting water-tight fastening.

According to the present invention there is provided a rivet made of synthetic plastics material comprising a head having a through bore, a hollow shank having an expansible wall, a mandrel extending through the head, the mandrel comprising a tail extending beyond the end of the shank remote from the head, a stem which is joined to the tail at a line of weakness and which extends through the bore in the head and an external abutment on the tail spaced from the said end of the shank, wherein the mandrel is joined to the shank by a frangible web of material and the dimensions of the tail are such that when a pulling force is exerted on the stem, the web is broken, the tail is drawn into the shank expanding the shank wall outwardly until the abutment on the tail engages the said end of the shank whereupon an increase in the pull exerted on the stem causes the mandrel to break at the line of weakness.

Several preferred embodiments of the invention will now be described by way of example with reference to the accompanying drawings in which:

Figure 1 is a section through a rivet according to the present invention located in an aperture in a support panel;

Figure 2 is a section on the line II—II of Figure 1;

Figure 3 is a section through the rivet of Figures 1 and 2 showing the rivet set and attaching a beading to the support panel;

Figure 4 is a plan view, partly in section of the assembly shown in Figure 3;

Figures 5 to 8 are views similar to Figure 1 showing four modified forms of rivet each comprising different embodiments of the present invention, and

Figure 9 is a view similar to Figure 3, showing the rivet of Fig. 8 in the set position.

The rivet shown in Figures 1 to 3 is indicated generally by the reference numeral 10 and is formed by injection moulding from a suitable synthetic plastics material such as nylon. The rivet 10 comprises a head 11, a hollow shank 12, and a mandrel which is indicated generally at 13.

The head 11 of the rivet has a stepped through bore 14 which is co-axial with the

bore 15 of the hollow shank 12. The bore 15 of the shank 12 is formed with a plurality of radially spaced, axially extending ribs 16 which are seen best in Figure 1. Each rib has a convex outer surface and terminates short of the junction between the head and the shank so as to form a Venturi-shaped constriction in the bore 15. The shank can, alternatively be provided with a continuous annular rib or projection, but the ribs have the advantage that they allow the material of the wall to stretch more easily when the shank is expanded.

The mandrel 13 comprises a tail portion 17 and a stem portion 18 divided by an area of weakness, which is formed by reducing the cross-section of the mandrel to form a frusto-conical neck 19. The stem portion 18 of the mandrel is joined to the shank 12 by an easily frangible web 20 of material which may comprise a continuous diaphragm of material or alternatively a plurality of separate angularly spaced ties. The mandrel can be joined at any convenient point to the wall of the bore in the shank or the bore in the head of the rivet.

The tail portion 17 of the mandrel is cylindrical and the diameter of the tail portion is slightly less than the maximum internal diameter of the shank 12 but substantially greater than the diameter of the imaginary inscribing circle "a" of the ribs 16, as shown in Figure 2. The outer end of the tail portion 17 remote from the stem portion 18 of the mandrel is formed with a projecting annular flange 21.

In Figure 1 the rivet 10 is shown with the shank 12 inserted through a circular aperture 22 in a panel 23. The diameter of the aperture 22 is the same as or slightly greater than the external diameter of the shank 12 so that the shank can be easily inserted through the aperture. In order to lock the rivet in the panel 23, a tool is applied against the head 11, the stem 18 of the mandrel is gripped and the mandrel is drawn upwardly through the shank 12 of the rivet. As an upward pull is applied to the mandrel, the web 20 breaks allowing the tail portion 17 to be drawn upwardly into the shank 12. While the mandrel is being drawn upwardly, a downward force is applied to the head 11 of the rivet to hold the head against the panel. As the tail portion 17 is drawn into the shank 12, the tail portion meets the ribs 16 which cause the wall of the shank 12 to stretch and expand outwardly into the position shown in Figure 3 in which the shank is locked in position in the aperture 22 in the panel.

The tail portion 17 of the mandrel is drawn upwardly until the flange 21 abuts the end of the shank 12. When this position is reached, a part of the tail portion 17 is located between the head 11 of the rivet and the ribs 16 on the shank so that the tail portion 17 cannot creep or resile back along the shank of the rivet. Finally, a further pull is applied to the stem 18 of the mandrel to break the stem away from the tail portion at the area of weakness or neck 19. The rivet 10 is then securely mounted in the panel 23 and cannot be removed in either direction.

The head 11 of the rivet 10 is provided with an undercut straight edge 24 on one side of the rivet and two spaced undercut edges 25 and 26 on the other side of the rivet. A beading 27 having inturned flanges 28 and 29 is attached to the panel 23 by locating the flange 28 between the undercut edge 24 and the upper surface of the panel and the flange 29 between the undercut edges 25 and 26 and the upper surface of the panel.

It will be appreciated that the rivet 10 can be used to attach two or more panels together or alternatively, the head 11 of the rivet can be formed to engage articles such as cables or rods so as to mount the articles on the panel 23.

Figures 5 to 8 illustrate four rivets comprising alternative embodiments of the invention and similar reference numerals are used in Figures 5 to 8 to indicate similar parts to the reference numerals used in Figures 1 to 4.

In Figure 5 a rivet is indicated generally at 40 which is similar to the rivet 10 except in so far as the mandrel 13 comprises a tail portion 41 which is hollow at 42 and joined to the bottom end of the shank 12 by an easily broken web 43.

The end of the stem 18 of the mandrel 13 is formed with a conical recess 44 so that the stem 18 is joined to the tail portion 41 at an area of weakness 45.

The rivet 40 is used in a similar manner to the rivet 10 and the relative wall thicknesses of the tail portion 41 and shank 12 are so arranged that when the tail portion is drawn into the shank 12 the wall of the shank 12 is expanded outwardly to lock the rivet in an apertured panel.

Figure 6 illustrates a rivet 50 which is similar to the rivet 40 except in so far as the mandrel 13 has a tail portion 51 which is solid and joined to the shank 12 by an easily broken web 52. Adjacent the stem 18 of the mandrel 13 the tail portion 51 is formed with a recess 53. The stem 18 is formed with a tapered tip 54 which is joined to the base of the recess and forms an area of weakness 55 which is stronger than the web 52 but which will break when a sufficient pull is applied to the stem 18 so as to break the stem away from the tail portion.

The rivet 50 is used in the same manner as the rivets 10 and 40 as described with reference to Figures 1 to 4 and Figure 5.

In Figure 7 a rivet is indicated generally at 60 which is similar to the rivet 50 except insofar as the recess 53 and tapered tip 54 of

the rivet 50 are replaced by a single through-slot 61 in a solid tail portion 62. The slot 61 forms an area of weakness 63 between the stem and tail portion of the mandrel which will break when a sufficient pulling force is applied to the stem of the mandrel so as to break the stem away from the tail portion 62. In all other respects the rivet 60 is similar to the rivet 50 and is used in the same manner.

In Figures 8 and 9 a rivet is indicated generally at 70 which comprises a further embodiment of the present invention.

The rivet 70 comprises a head 71, a hollow shank 72 and a mandrel which is indicated generally at 13. The head 71 and shank 72 are similar to the head and shank of the fastener 10, except that the shank 72 does not have any internal ribs and is internally cylindrical and smooth walled.

The mandrel 13 comprises a stem 75 and a tail portion which is indicated generally at 76. The stem 75 has an end portion 77 which projects beyond the end of the shank 72. The tail 76 comprises a sleeve 78, which surrounds the end portion of the stem and a locking pin 79 which is joined to the end portion 77 of the stem at a line of weakness 80. The sleeve 78 is joined at one end of the end of the shank 72 by a first web 81 and at the other end to the end portion 77 of the stem by a second web 82. A first external abutment flange 83 is provided at the end of the sleeve 78 which is joined to the shank 72 and a second external abutment flange 84 is provided on the locking pin 79 at the end of the pin remote from the flange 83. The external surface of the sleeve 78 is formed with annular projections or an annular projection in the form of a continuous rib 85.

In use, the head 71 of the rivet 70 is held against the upper surface of a workpiece in the same manner as the rivet 10 of Figures 1 to 4 and the stem 75 of the mandrel 13 is pulled upwardly. Initially, the web 81 breaks away so that the sleeve and the locking pin are drawn into the shank 72 until the flange 83 abuts the end of the shank. A further pull on the stem 75 causes the web 82 to break and the locking pin 79 is then drawn into the sleeve 78. This expands the sleeve 78 and the shank 72 in the region of the rib 85. A further pull on the stem 75, causes the stem to break away from the tail portion 76 at the area of weakness 80 leaving the rivet securely mounted in the apertured panel.

Certain types of synthetic plastics material can be stretched more readily than others. If the material can be stretched sufficiently then a continuous expanding rib 85 can be used. If however the material employed cannot be readily stretched, then a plurality of spaced ribs 16 are preferred so as to minimise the risk of overstretching and damaging the shank of the rivet.

WHAT WE CLAIM IS:—

1. A rivet made of synthetic plastics material comprising a head having a through bore, a hollow shank having an expansible wall, a mandrel extending through the head, the mandrel comprising a tail extending beyond the end of the shank remote from the head, a stem which is joined to the tail at a line of weakness and which extends through the bore in the head and an external abutment on the tail spaced from the said end of the shank, wherein the mandrel is joined to the shank by a frangible web of material and the dimensions of the tail are such that when a pulling force is exerted on the stem, the web is broken, the tail is drawn into the shank expanding the shank wall outwardly until the abutment on the tail engages the said end of the shank whereupon an increase in the pull exerted on the stem causes the mandrel to break at the line of weakness.

2. A rivet as claimed in claim 1, wherein the shank is formed with an internal constriction and the length of the tail is such that a part of the tail is located between the head and the constriction when the abutment engages the said end of the shank.

3. A rivet as claimed in claim 2, wherein the internal constriction is Venturi-shaped.

4. A rivet as claimed in claim 2 or in claim 3, wherein the constriction is formed by a plurality of internal, radially spaced, axially extending ribs.

5. A rivet as claimed in any preceding claim, wherein the tail is hollow.

6. A rivet as claimed in any of claims 1 to 4, wherein the line of weakness between the stem and the tail of the mandrel is formed by a slot extending transversely through the mandrel at the junction between the stem and the tail.

7. A rivet as claimed in any preceding claim, wherein the stem of the mandrel is joined to the wall of the shank by the said web of material.

8. A rivet as claimed in claim 1, wherein the stem of the mandrel extends through the shank and projects beyond the end of the shank remote from the head and the tail of the mandrel comprises a sleeve which is joined to the said end of the shank by a first web and to the stem of the mandrel by a second web of material, a locking pin which is joined to the stem of the mandrel at the said line of weakness and which extends beyond the end of the sleeve remote from the shank, a first external abutment on the sleeve and a second external abutment on the locking pin, the arrangement being such when a pulling force is exerted on the stem, the first web breaks and the sleeve is drawn into the shank until the first abutment engages the shank, a further pulling force breaks the second web drawing the locking pin into the sleeve until the second abutment engages the

sleeve and a further pulling force breaks the mandrel at the line of weakness.

9. A rivet as claimed in claim 8, wherein the bore in the shank is substantially cylindrical and the sleeve is formed with an external projection or a plurality of external projections adapted to expand the wall of the shank outwardly when the tail of the rivet is drawn into the shank.

10. A rivet substantially as described herein with reference to Figures 1 to 3, Figure 4, Figure 5, Figure 6, Figure 7 or Figures 8 and 9 of the accompanying drawings.

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Sheet 1

Fig.1

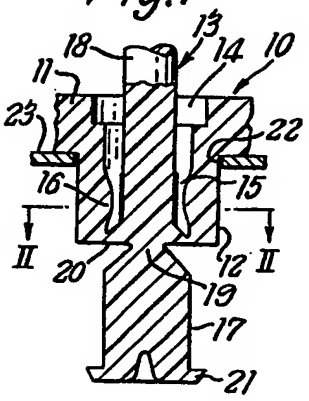


Fig.2

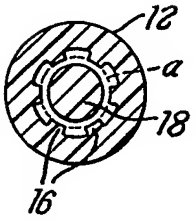
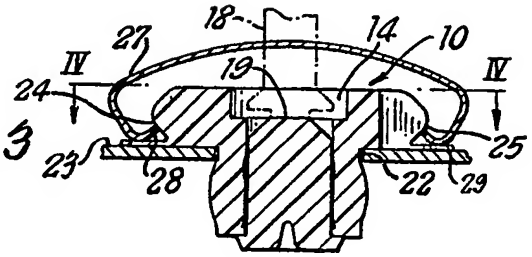


Fig.3



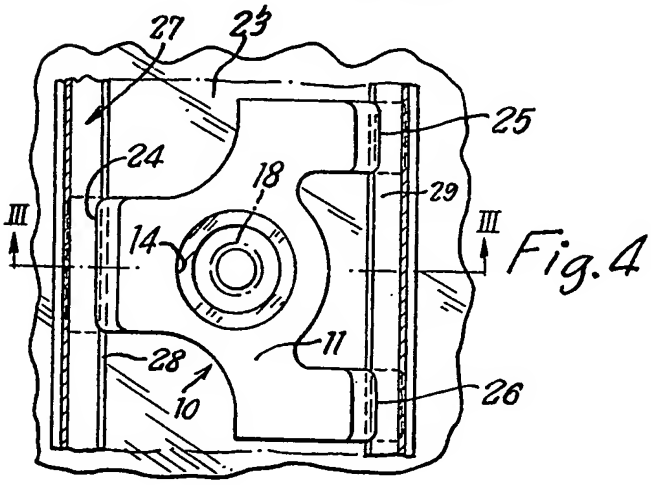


Fig.4

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Sheet 2

Fig.5

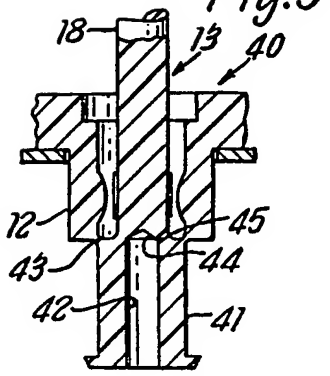
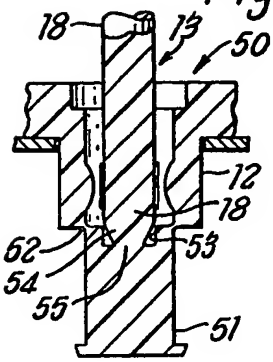


Fig.6



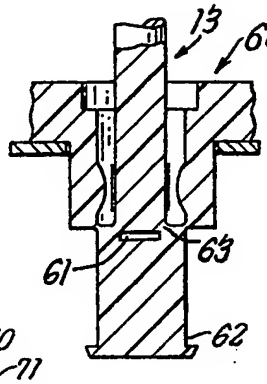


Fig.7

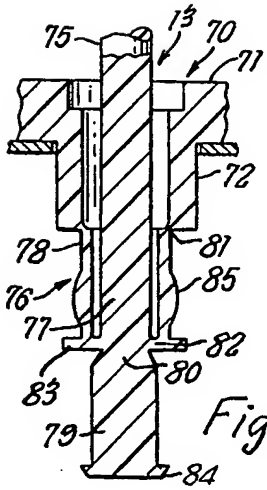
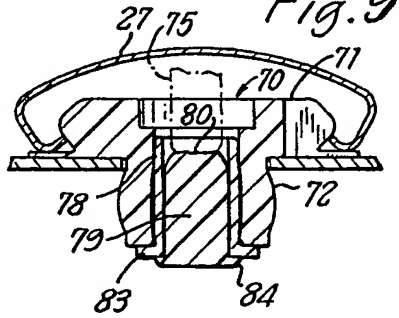


Fig.8

Fig.9



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